Mathematics, Statistics, and Computer Science **@ UIC**

Departmental Colloquium

The Role of Quantitative and Covariational Reasoning in Understanding Key Ideas of Trigonometry in Precalculus

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Abstract: Understanding and using trigonometric functions is difficult for both students and secondary teachers. These difficulties range from weak understandings of topics foundational to trigonometry (e.g., angle measure and function) to incoherent conceptions of the various contexts in which trigonometry is applied (e.g., the unit circle and right triangles). As an example, students often have difficulty reasoning about trigonometric functions as functions defined on the real numbers. This talk reports results of an investigation into the understandings and reasoning abilities involved in learning ideas of trigonometry. The data was collected in the context of a teaching experiment designed to support precalculus students in developing conceptions of angle measure, images of the radian as a unit of measurement, and connections across the contexts of trigonometry. It was hypothesized that these foundational conceptions constructed by the students would support the students in developing coherent understandings of trigonometric functions. The curriculum also promoted student reasoning abilities (e.g, quantitative and covariational reasoning) and function understandings that are foundational for learning central ideas of calculus. Findings from the investigation revealed information about student understandings of angle measure that are needed to understand and use trigonometric functions. Specifically, the study gained insight to the role of student conceptions of the radian as a unit of measurement when students are asked to reason about angle measure

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and trigonometric functions. Analysis of the collected data also illuminated the critical role of students' conceptualization of quantities as varying, prior to formalizing an understanding of sine and cosine as functions defining the relationship between two covarying quantities.

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